

Facial Image Processing and Analysis (FIPA)

<http://face.cs.kit.edu/>

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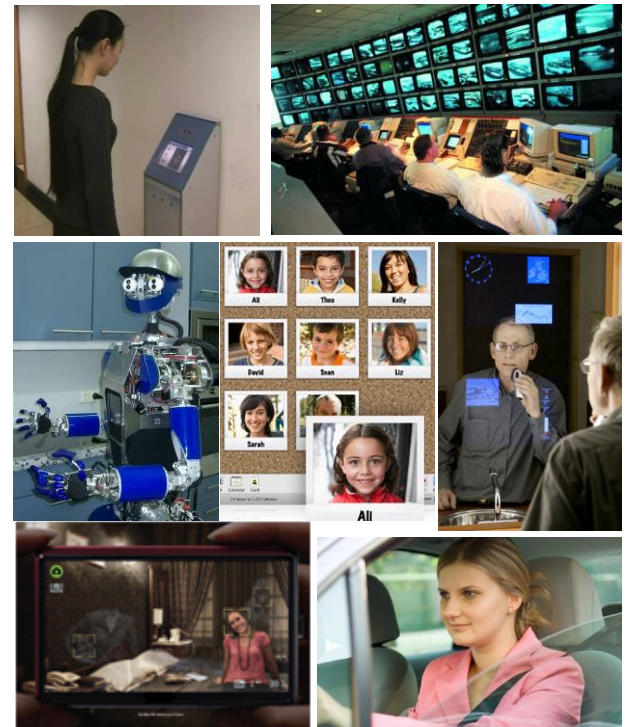
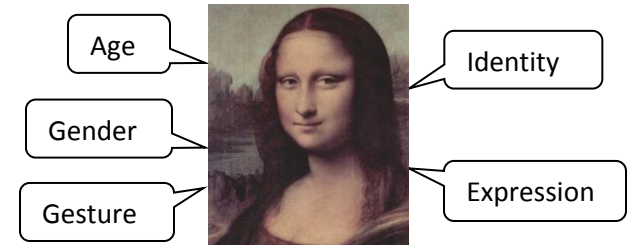
Karlsruhe, 21/10/2010

INSTITUT FÜR ANTHROPOMATIK, FAKULTÄT FÜR INFORMATIK



Facial Image Processing and Analysis (FIPA)

- *The task of automatically analyzing face images to acquire information about the depicted persons, e.g. age, expression, gender, gesture, and identity.*
- A wide range of application domains: security, smart environments, human-computer interfaces, content-based image and video analysis ...
- High commercial exploitation potential: Current market size of “face recognition for security domain” is 350 million USD, projected to exceed 1 billion USD in 2014*



*Source: Biometrics Market and Industry Report 2009-2014, International Biometric Group, Oct. 2008

FIPA members

■ PhD Students

- Mika Fischer
- Hua Gao
- Tobias Gehrig

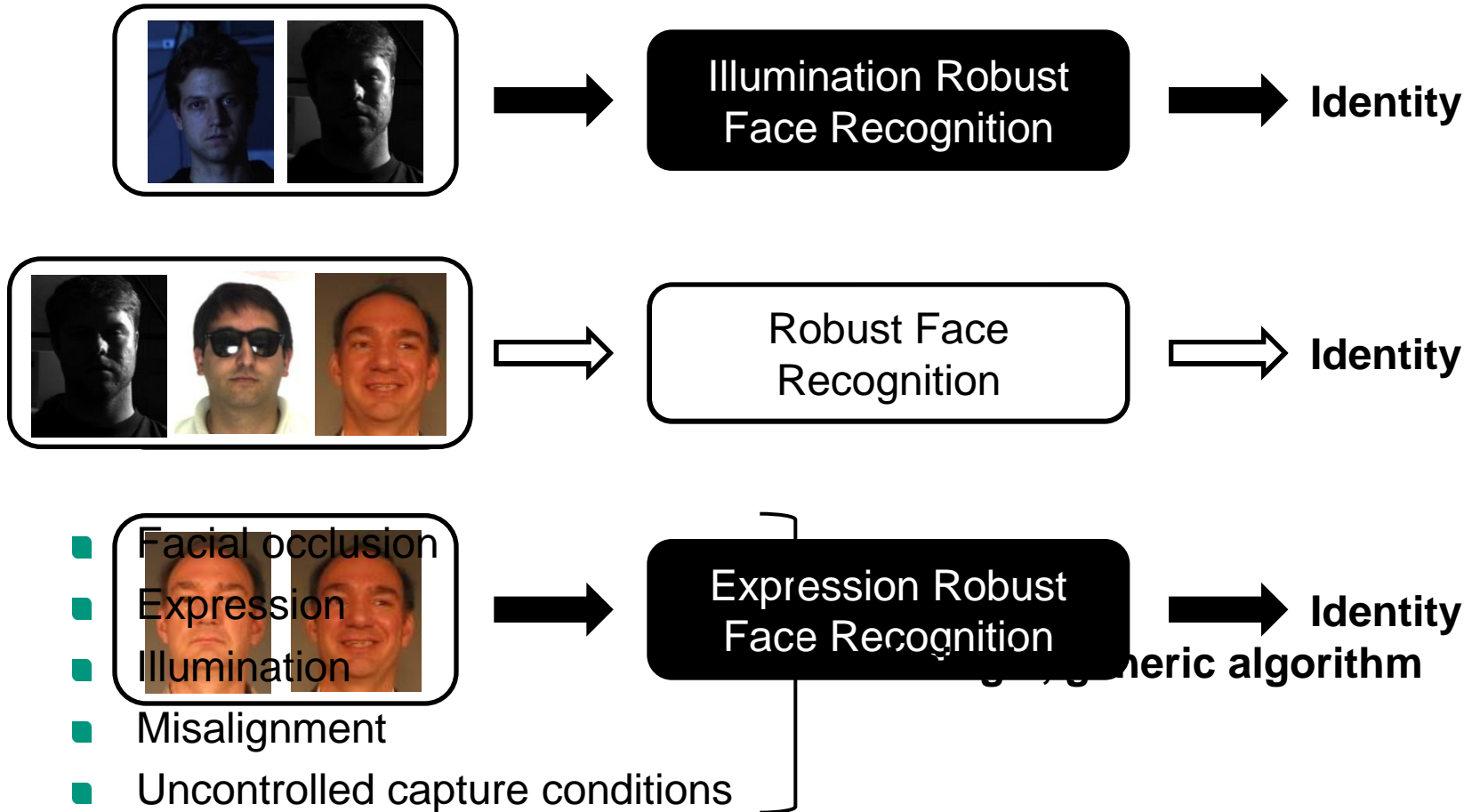
Visiting:

- Luo Dan (Waseda Uni., Japan)

■ B.S./M.S. Students

- Nikolas Hesse
- Elena Astankow
- Benjamin Hujer
- Derick Beng Yuh
- Chengchao Qu
- Matthias Richter
- Matthias Steiner

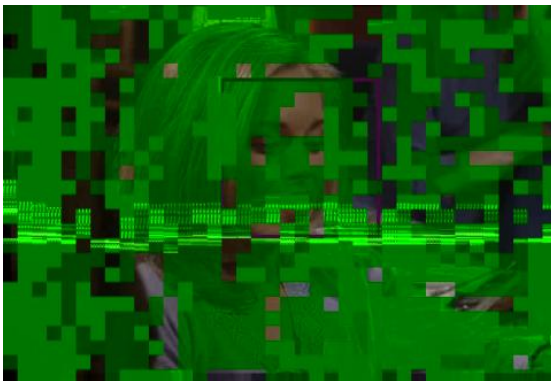
Current State of Research*



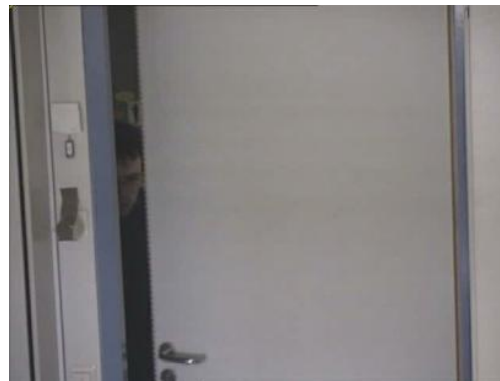
*A Robust Face Recognition Algorithm for Real-World Applications (H.K. Ekenel, Ph.D. thesis, University of Karlsruhe (TH), Feb. 2009, Supervisors: A. Waibel, J. Kittler)

Outcomes and Achievements

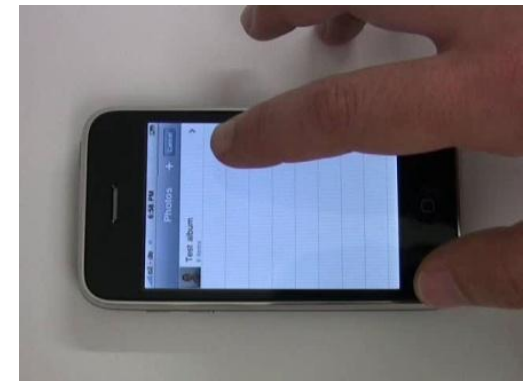
- Over 40 publications in peer reviewed international journals & conferences
- EBF European Biometric Research Award 2008
- Best performing systems in the CLEAR Evaluations 2006, 2007
- Leading face recognition research in the CHIL, SFB 588 and Quaero projects
- A wide range of real-world applications (Best Demo Award @ IEEE International Conference on Automatic Face and Gesture Recognition 2008)



Person Retrieval in Movies



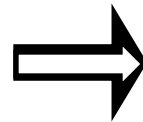
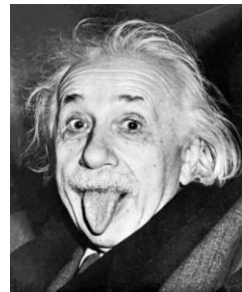
Entrance Monitoring



Face Labeler

Objective

To read the face



Age Classification



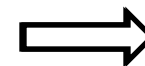
Age Interval

Expression Recognition



Expression

Facial Image
Processing and Analysis



Age, Expression,
Identity
Gender, Gesture,
Identity

Gender Classification



Gender

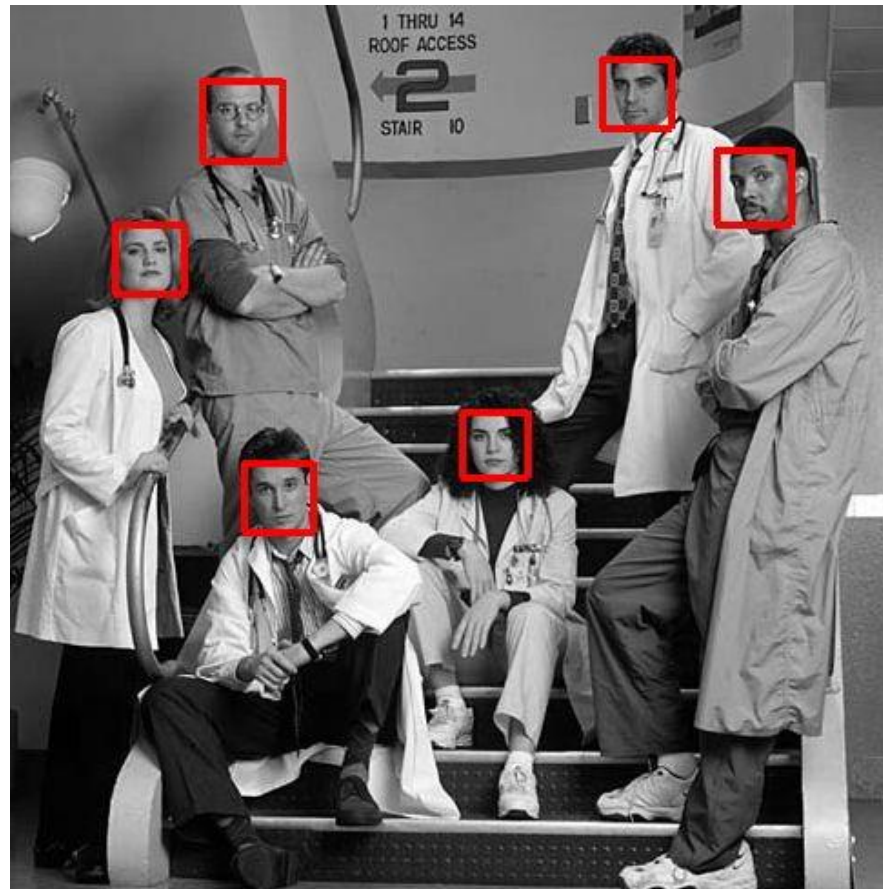
Gesture Recognition



Gesture

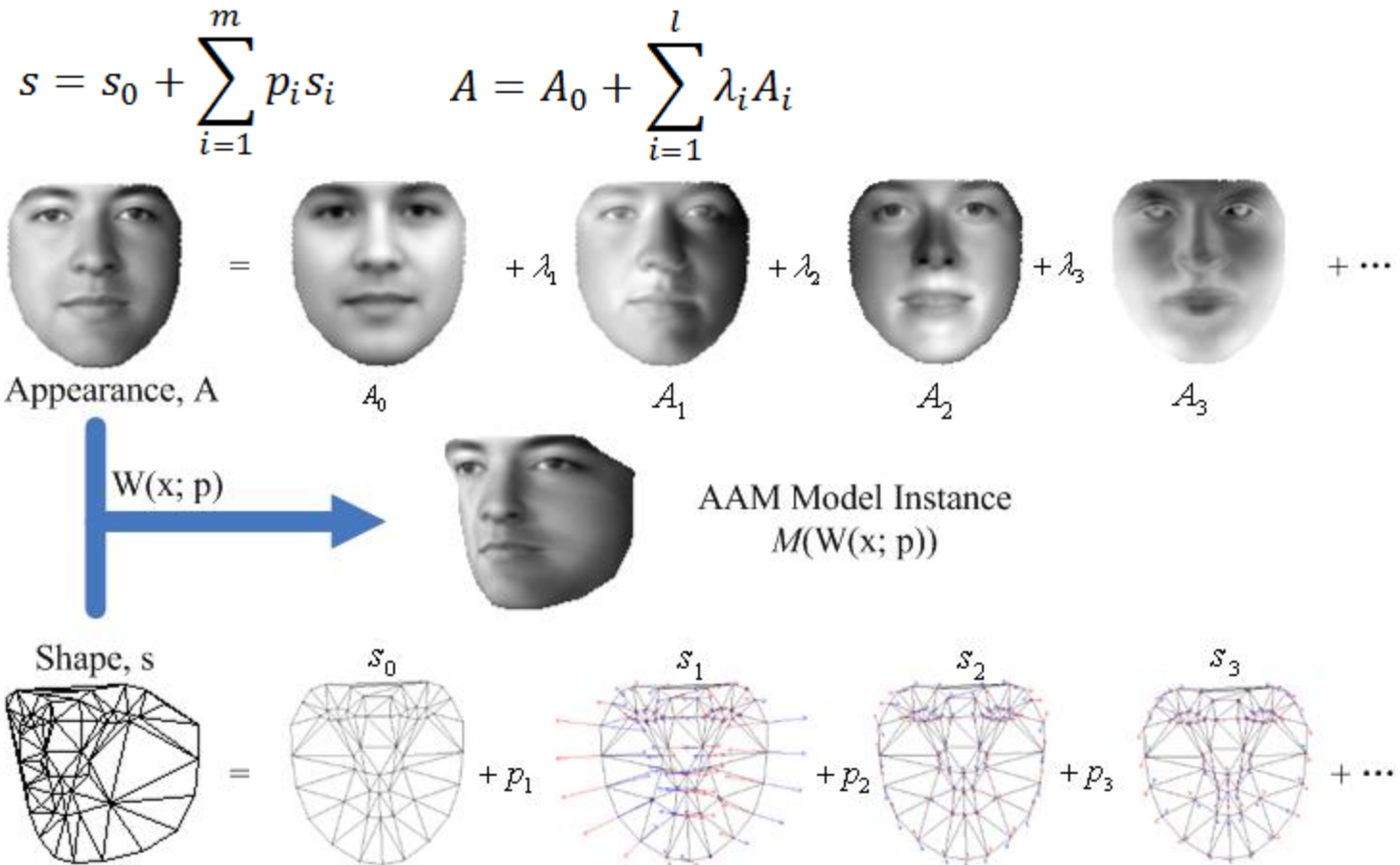
- ➡ Robust face detection, facial feature localization and tracking across different poses
- ➡ A single, shared face representation for all the information in the face image

Face Detection

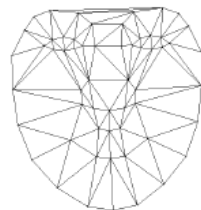


Face Modeling with Active Appearance Models

- A generative model



2D AAMs Example


 s_0

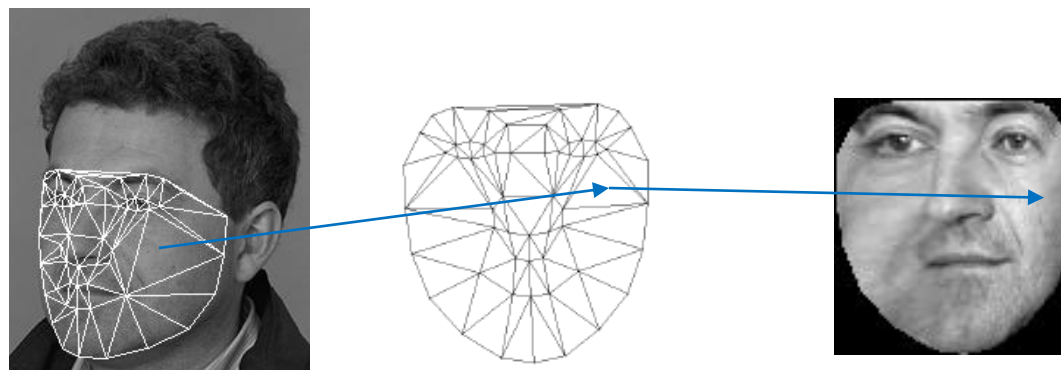
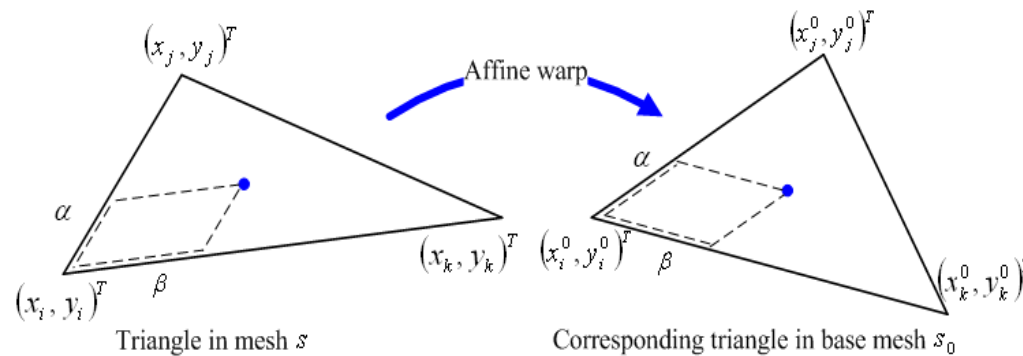
 $s_0 + p_1 s_1$
 $s_0 + p_2 s_2$
 $s_0 + p_3 s_3$

 $A_0(x)$

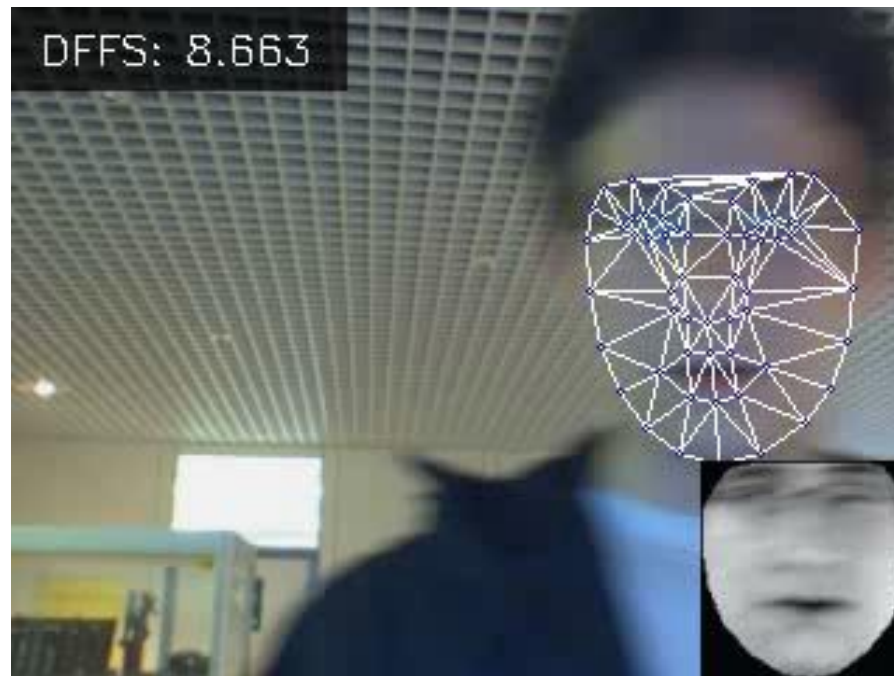
 $A_0(x) + \lambda_1 A_1(x)$
 $A_0(x) + \lambda_2 A_2(x)$
 $A_0(x) + \lambda_3 A_3(x)$

Model-based Face Registration

- Non-linear morphing with piece-wise affine warp



Active Appearance Model Tracking in Video



Face Verification



Multi-resolution face models:



Face Recognition Grand Challenge,
Experiment 4: Controlled vs. Uncontrolled matching:
92.5% VR @ 0.1 FAR **Best published result!**



Pair Matching / Face Recognition in Wild

- Given
 - Two face images
- Not given
 - Training data of the same persons
 - Facial feature locations
- Task
 - Classify whether it's the same person
- Quite difficult problem!

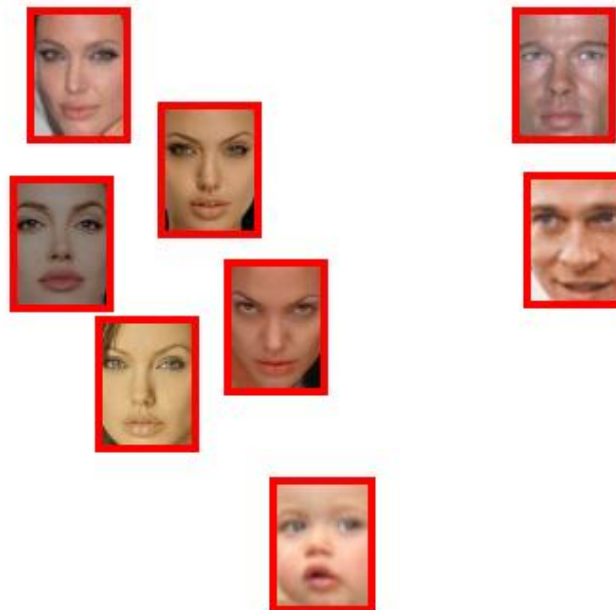


Same person?



Web Image Search: Example

Angelina Jolie

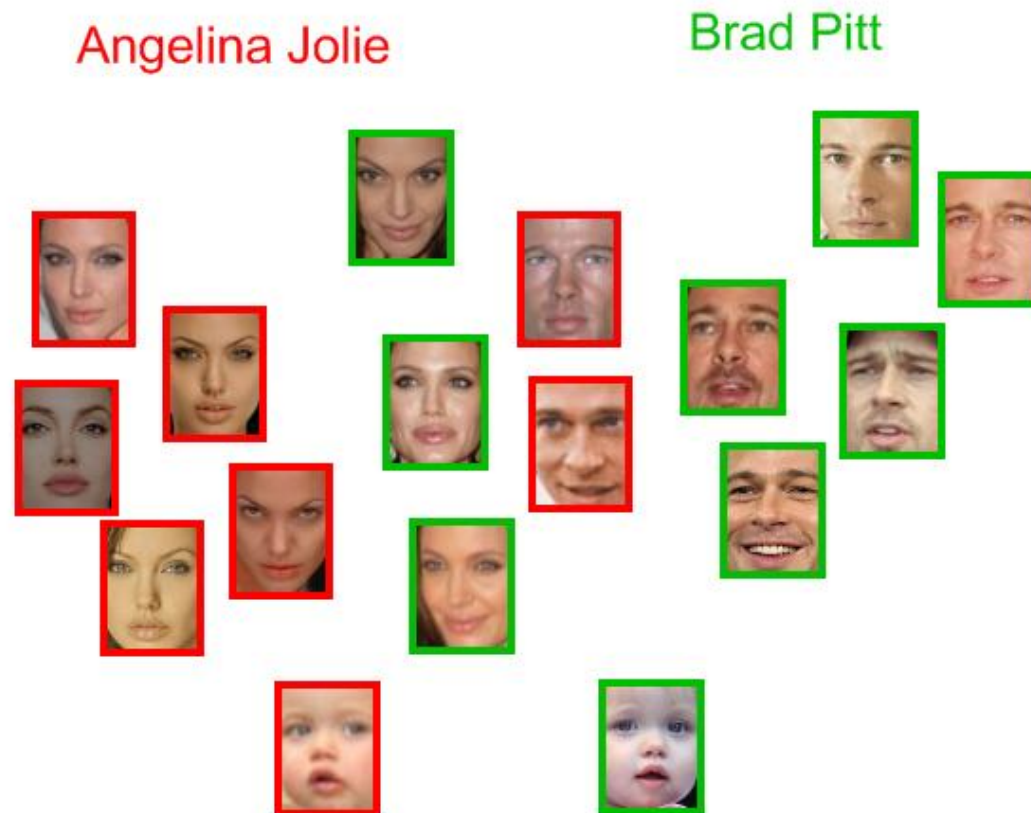


Web Image Search: Example

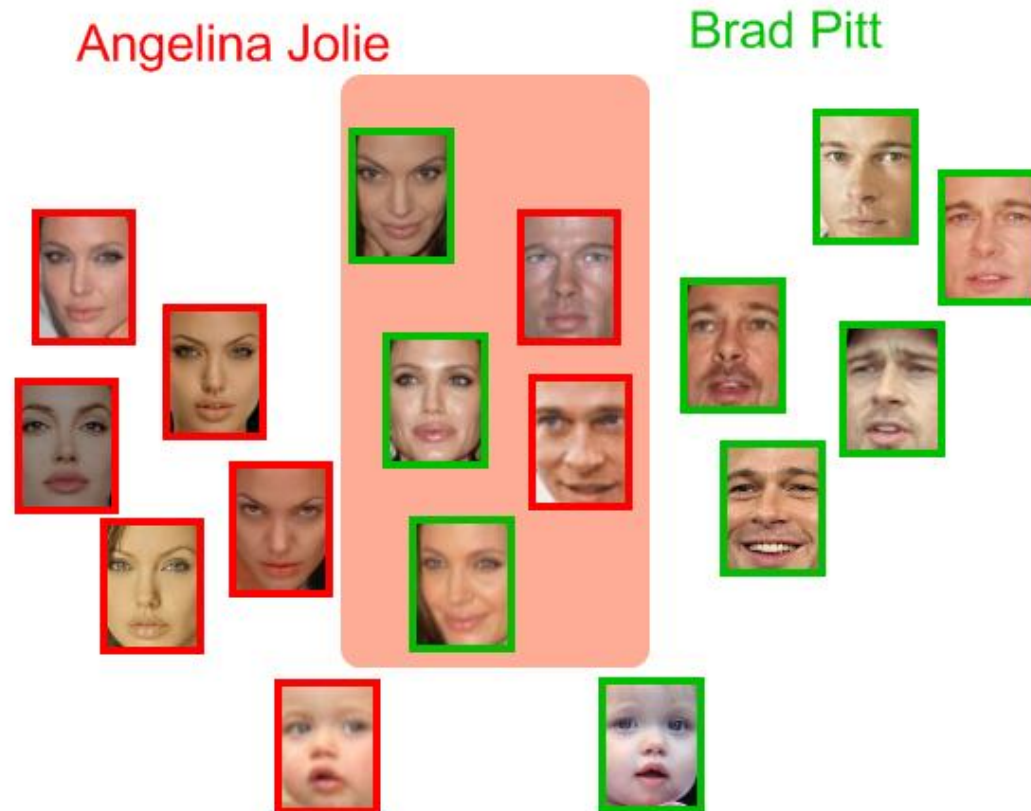
Brad Pitt



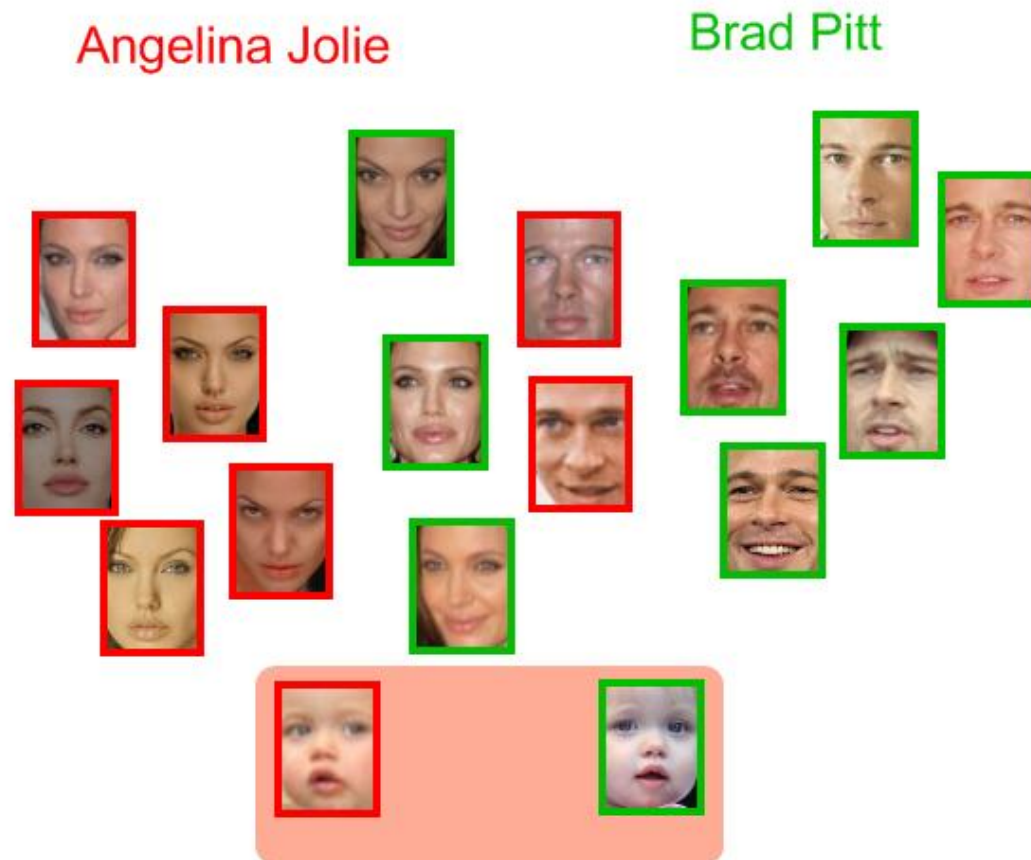
Web Image Search: Example



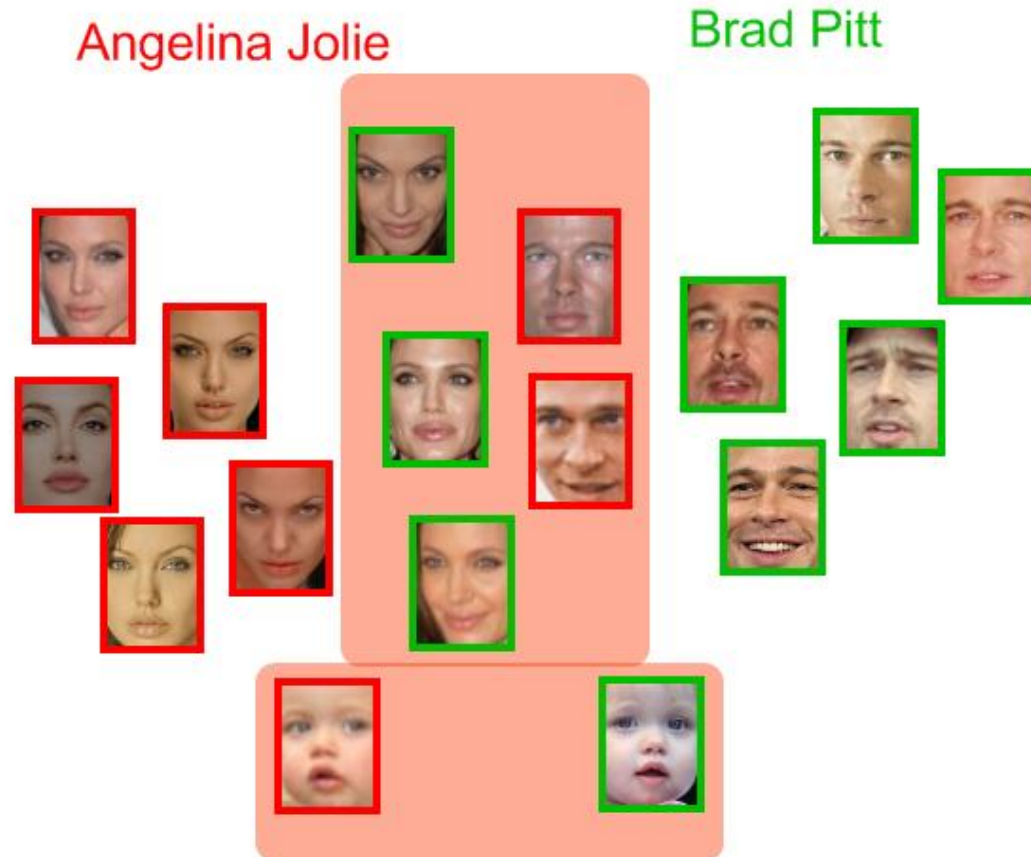
Web Image Search: Example



Web Image Search: Example

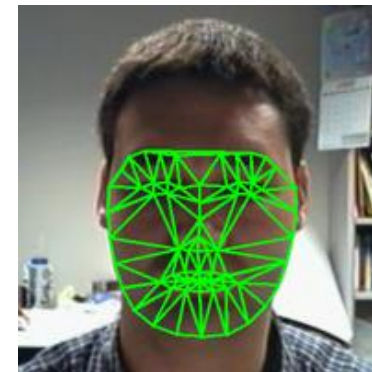
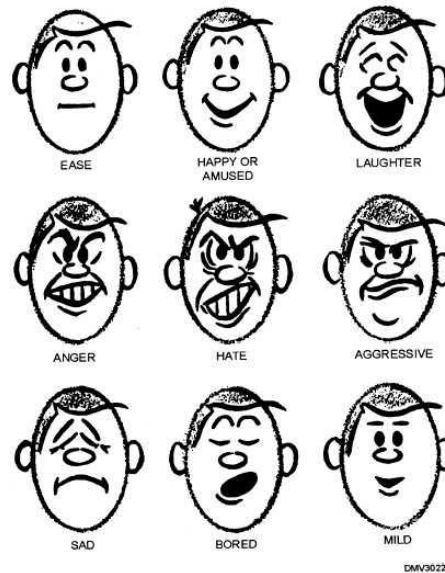
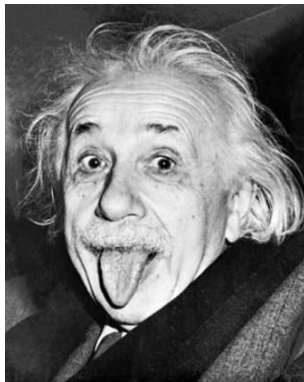


Web Image Search: Example



Facial Expression Analysis

- Facial Action Coding System (FACS)
- Recognizing facial action units (AU)
- Emotion Classification (Happy, sad, angry, etc ...)



Age Estimation



Gender Classification



Real-World Applications*

Surveillance: 92.5%, 41 subjects



ICCV'07

Access Control: 100%, 25 subjects



ACM MM'08

Smart Environments:
Best system in the CLEAR evals
(96.4%, 28 subjects)



*Winner of the Best Demo Award in IEEE Intl. Conf. on Automatic Face and Gesture Recognition (FG 2008)

Real World Applications*

Person retrieval in TV series:

Recall: 91.3%, Precision: 98.8%



FG'08

Humanoid Robots:



IEEE Trans. on Robotics'07

***Winner of the Best Demo Award in
IEEE Intl. Conf. on Automatic Face and
Gesture Recognition (FG 2008)**

Organization of the Seminar

- Aufgabe: Präsentation eines Themas basierend auf 1-2 wissenschaftlichen Papers
- Pro Termin ein Vortrag mit anschließender Diskussion
- Regelmäßige Anwesenheit erforderlich
- Bitte die Papers zu den jeweiligen Vorträgen *vorher* lesen (Download über die Webseite)
- Ausarbeitung erforderlich

Der Vortrag

- Mindestens 2 Treffen mit dem Betreuer:
 - Besprechen der vergebenen Papers
 - Besprechen der Folien
- 30min Vortrag + 10min Diskussion
- Sprache für Vortrag und Folien: Englisch
- Vortrag vorher üben!
- Die zentralen Vokabeln kennen, ggf. Aussprache nachschlagen
- Ausreichend laut, langsam und deutlich sprechen

- Richtwert: pro Folie knapp zwei Minuten einplanen
 - Vorher überlegen, welche Folien notfalls ausgelassen werden können
- Vollständige Referenzen auf die Papers, auf denen der Vortrag basiert
- Jeden auf den eigenen Folien vorkommenden Begriff erklären können
- Nach Bildern/Videos zum Paper suchen

Gliederung

■ Einleitung

- Problemdefinition / Ziel (einfach und für jeden verständlich halten!)
- Einordnung, verwandte Arbeiten

■ Verfahren

- Vor dem “Wie” an das “Warum” erinnern
- Wenn Formeln notwendig: alle Bestandteile erklären

■ Experimente

- Komplizierte Tabellen ggf. aufbrechen

■ Zusammenfassung

- Offene Probleme

- Eigener Name, Datum, Foliennummern
- Ausreichende Schriftgröße und Kontrast
- Den Rändern nicht zu nahe kommen
- Format für die Folienabgabe: pdf oder ppt
- Bei Grafiken: Legende und Achsenbeschriftungen nicht vergessen

Possible Topics

- Face detection
- Facial feature localization
- Face modeling
- Face recognition
- Face verification
- Facial expression analysis
- Emotion classification
- Age estimation
- Gender classification
- Facial gesture recognition

Thank you for your attention

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